

# THE AMERICAN REVIEW OF REVIEWS

AN INTERNATIONAL MAGAZINE

EDITED BY ALBERT SHAW

VOLUME LXI

JANUARY-JUNE, 1920

THE REVIEW OF REVIEWS COMPANY  
NEW YORK: 30 IRVING PLACE

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**TERMS:**—Issued monthly, 35 cents a number, \$4.00 a year in advance in the United States, Porto Rico, Hawaii, Cuba, Canada, Mexico, and the Philippines. Elsewhere \$5.00. Entered at New York Post Office as second-class matter. Entered as second-class matter at the Post-Office Department, Ottawa, Canada. Subscribers may remit to us by post-office or express money orders, or by bank checks, drafts, or registered letters. Money in letters is sent at sender's risk. Renew as early as possible in order to avoid a break in the receipt of the numbers. Bookdealers, Postmasters and Newsdealers receive subscriptions.

THE REVIEW OF REVIEWS CO., 30 Irving Place, New York

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June—1

ALBERT SHAW, Pres. CHAS. D. LANIER, Sec. and Treas.

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UNIVERSITY OF CALIFORNIA

the township board reserves the right to prescribe the fees which shall be collected by the physician. Tentatively the charge of \$2 per call made within the township boundaries, together with mileage at the rate of 50 cents per mile traveled, has been set as the fee the physician shall collect. When a call is made outside the township the charge shall be \$3, with the same mileage charge. However, \$1 of each \$3 fee so charged shall revert to the township treasury. Charges for confinements, operations, and other unusual attendance are to be made in accordance with the county medical society's fee schedule.

It is the intention of the officials in charge of the project to have the physician act as health officer and serve as medical attendant to the indigent supported by the township. He is also to serve as school physician, making a physical examination of the pupils at least once in three months during the school term. Furthermore, he is to advise the members of the board of health in professional matters.

A similar plan for solving this problem is set forth in a recent editorial in the *Boston Medical and Surgical Journal* in the following terms:

There are many small communities throughout the country that are without physicians. Some which have come to our notice have been so for three years and are without any prospects of

obtaining a practitioner. Such a condition is a calamity. How to secure adequate medical attention and at the same time have it efficient is the problem which is before these communities. Physicians cannot work without adequate compensation—just what that compensation must be depends upon the cost of living and the work required; but it is very doubtful if satisfactory medical service can be obtained unless the physician has an income of from \$3600 to \$5000 a year. Most communities can afford this amount.

While we do not approve of a "contract practice," we do believe that communities that are without medical attention should make a contract with a physician which should take the form of a guaranty of a certain salary for the year. He should be free to charge the regular fee, but if at the end of the year he has not collected the specified amount the deficiency should be made up to him. What would this mean to the community of perhaps 1000 persons? A guaranty of \$3600 would mean \$3.60 per year per individual, or, in round numbers 30 cents per month, or 7½ cent per week. Any community can afford that sum. There are many capable young men who have just graduated from college who would be glad to enter into such an arrangement and who would do good work. The trouble at present is that communities wish the physicians to come to them and take all the risks of making a living, regardless of the fact that larger communities usually offer better opportunities for success.

## DR. VORONOFF'S EXPERIMENTS IN HUMAN GRAFTING

WHEN a new scientific idea is given to the world, it is rarely grasped at once in its entirety by the public at large. If it happens to carry with it some corollary having an especially sensational flavor, the chances are that this subordinate detail will spread like wildfire along the channels provided by the newspapers and the popular magazines, while the broad, fundamental features of the revelation will lag behind—not only for days, but even for generations. For example, it is notorious that the all-embracing theory of evolution was popularly understood, for decades after its enunciation, to be hardly anything more than the assertion of man's simian ancestry.

Just as Darwinism used to mean to the average citizen, and perhaps still does, the doctrine that mankind is descended from monkeys, so the recent far-reaching experiments of Dr. Serge Voronoff in the grafting of animal organs, bones, and tissues seem to have been reduced, in popular apprehension, to certain undertakings in the transplantation of the thyroid gland. The similarity to the case of Darwinism extends even to the

prominence of the monkey—since the glands of apes were used in the experiments which have lately figured in the newspapers.

Fortunately Dr. Voronoff has presented a comprehensive account of his work in *La Revue* (Paris), and an abstract and partial translation of his article appears in the *Scientific American Monthly*. Thus we are able to glean important information which failed to reach us by way of the cables.

It appears that Dr. Voronoff, a former pupil of Dr. Carrel at the Rockefeller Institute, has been studying for many years the process of grafting, as applied to animals and man, with a view to ascertaining the conditions that insure success in such operations. He says:

I undertook certain experiments in order to determine the conditions which might insure the definite vitality of grafted organs. I soon perceived that the organs borrowed by one animal from another of the same species sometimes exhibit signs of retrogression and atrophy. I concluded that the borrowed organ failed to find the proper vital conditions and nutritive environment in its new host necessary for its continued existence.

Every living being represents a highly personal individual entity, possessing a peculiar temperament and blood character, which, while similar to that of other individuals of the same species, nevertheless has certain peculiarities which differentiate the intimate biological conditions of the cell life in our organs. This individual difference varies in degree, and it occurred to me that it must certainly be possible to find some individuals which were more closely similar than others among the same species. I based this opinion upon the fact that some individuals are found whose blood when mingled forms a uniform liquid wherein it is impossible to distinguish the portions coming from one or the other. There are others on the contrary whose blood immediately coagulates in contact with the added blood, and there are still others whose blood acts like an acid upon the blood which is poured into it, dissolving and destroying the red corpuscles. An organ borrowed from an individual whose blood is very different from that of the individual in which it is planted is naturally certain to die, since its nutritive environment is suddenly changed. On the other hand when the transplanted organ finds the same conditions which governed its previous life it continues to live in a normal manner.

Family relationship was found to be favorable to grafting experiments and the author was able, in the case of closely related sheep, to transplant even very delicate and complex organs, which exhibited perfect vitality at the end of two years.

Having thus proved his theory by animal experimentation, Dr. Voronoff proceeded to undertake human grafting. Shortly before the outbreak of the war he reported to the Academy of Medicine in Paris a remarkable case wherein he improved the condition of a child who was idiotic because of the atrophy of the thyroid gland by grafting upon it a thyroid gland of a monkey, and a still more remarkable case where he grafted a portion of a thyroid gland of a mother upon her son with remarkable results. The latter, a youth of twenty, resembled a child of ten in appearance, having been born without a thyroid gland. He had remained small, fat, with a neck sunken in his shoulders and the cretinoid face which recalls an animal. This boy, dull and apathetic, able to pronounce only a few intelligible words, and hiding in corners like a frightened animal, presented a painful contrast to his brother only a year older, but a big, vigorous fellow fighting bravely at the front.

In 1915 the mother, a strong and intelligent woman, gladly consented to have a portion of her own thyroid gland removed and grafted upon her son. The operation was highly successful, and at the end of a year an absolutely marvelous change was found in the afflicted youth. He had begun to grow, gaining sixteen centimeters (over six inches) in the year, his head was no longer sunken between his shoulders. The bloated look had disappeared; best of all, his mind had been awakened. He was able to talk distinctly and he is at present earning his living by working in a bakery.

Dr. Voronoff was able to apply his discoveries on a very extensive scale during the war to the treatment of shattered bones, in a hospital especially devoted to grafting operations. The process is thus described:

The first problem is to decide where to take the graft; as I have said, it is necessary that these grafts should find the same nutritive environment, and the same biological conditions in the new host, which they previously had. When the wounded man is able to bear it, the best thing, therefore, is to take the needed fragment of bone from his own body. At first the idea seems paradoxical, since the proposition is to repair a fractured leg or arm by breaking another bone of the wounded man. Happily the reality is less tragic than it seems. Nature has thoughtfully given us a bone which we can dispense with, without suffering any inconvenience. This is the fibula, that thin but solid bone which is able to bear a weight of 70 kilos (154 pounds) without breaking, and which is fastened to the tibia. Our body is supported by the femur which is joined directly to the tibia and not to the fibula, which we retain as a vestige of an ancestral condition, and which we can dispense with without trouble, at any rate its upper part. Moreover, there are many animals which are excellent runners and yet do not possess this bone.

When taken from the invalid himself this bone naturally finds the same vital conditions to which it is accustomed, and it is grafted with great ease in the new area to which it is transplanted. Placed between parts of bones which are larger than itself, such as the femur or the tibia, it not only welds the broken parts together but it becomes larger itself, becoming indeed almost as large as the femur or tibia, thanks to the more abundant nutrition which it receives from the bigger blood vessels in its new position, and thanks also to the marvelous adaptability of every organ to its new function. This growth in volume naturally requires a certain length of time, sometimes a year or longer. But this bone is not the only one which can be used as material for grafting. The graft is often borrowed from the tibia, by cutting a piece of a certain thickness out of it, especially to repair an arm bone. The tibia is such a thick bone that it can stand such a loss without injuring its solidity; in fact, the wounded man who has had a piece of bone borrowed from his leg to mend his arm is able to get out of bed and walk without trouble ten days after the operation. In other cases I have borrowed a bony fragment to fill in a fractured bone from the longest fragment of the injured bone itself.

Though what Dr. Voronoff calls "auto-grafts"—i. e., grafts from the same individual—give the greatest assurance of success, it is quite possible to graft bones taken from another human being or a lower animal, and it is even thought feasible to borrow bones from dead men to mend those of the living, since bone is said to retain its vitality for about eighteen hours after the general death of the individual.

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